Opportunity Title: Turbine Power Sciences and High Temperature Propulsion Materials Research
Opportunity Reference Code: ARL-C-WMRD-300128-MS

Organization DEVCOM Army Research Laboratory

Reference Code ARL-C-WMRD-300128-MS

Description **About the Research**

DEVCOM Army Research Laboratory is looking for enterprising scientists and engineers to conduct Vertical Takeoff Lift (VTOL) Turbine Power Research at CCDC Army Research Laboratory. ARL is conducting disruptive advanced materials and turbomachinery concepts / technologies for highly improved power-density, durability and efficiency for advanced VTOL gas turbine propulsion systems that address power demand, speed, range and low-cost sustainment gaps. The objective of this research is discovery and operationalization of advanced material systems, multi-physics high-fidelity computational methods and advanced turbomachinery concepts for future Army VTOL propulsion. It is operationalizing VTOL Turbine Power Science for technology overmatch of US military. This will lead to improved power-density, durability, and high efficiency technologies for transition to Army VTOL propulsion.

The main research thrust areas are:

• Advanced Ceramic Composite Systems
• Ultra High Temperature Ceramics for Propulsion
• Advanced Thermo-Fluid Models in Pressure Gain Combustor Environments
• Advanced Gas Generator Turbine Concepts

The metrics for the research are (a) durable turbine material system will provide 30% increased life; (b) Next-generation ultra-high temperature ceramics enabling 50% improved efficiency/power-density; (c) High-fidelity computational methods for predictive designs of novel turbomachinery concepts; (d) Advanced turbomachinery concepts, material systems, and turbine configurations enabling 50% improved efficiency/power-density and 30% improved durability

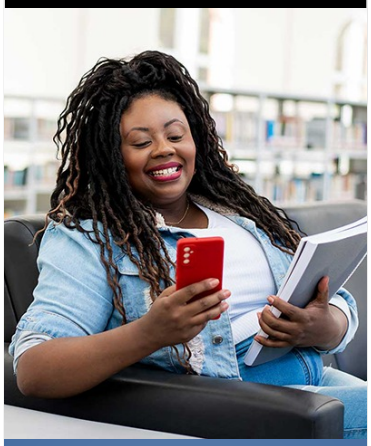
The knowledge products of this research are:

• Increased knowledge of processing-structure-property (PSP) relationships for technical/refractory ceramics, ultra-high temperature ceramics (UHTCs), and hybrid materials exposed to extreme conditions.
• Advanced low-k refractory ceramic materials, with high fracture toughness and attrition-resistance
• High-accuracy fluid-structure interaction models in multiphase turbulent internal flows with low computational-cost
• Advanced turbomachinery concepts and designs enabling responsive propulsion systems with high power density

Keywords: High Temperature Propulsion Materials, Ceramics Turbomachinery Sciences, Advanced Gas Turbine Engine, Fluid-Structure

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interaction models, Internal fluid dynamics, Adaptive Cycle Convertible Engines

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About Army Research Directorate (ARD)

ARL's Army Research Directorate (ARD) focuses on exploiting concept development, discovery, technology development, and transition of the most promising disruptive science and technology to deliver to the Army fundamentally advantageous science-based capabilities through laboratory's 11 research competencies. This intramural research directorate also manages the laboratory's essential research programs, which are flagship research efforts focused on delivering defined outcomes.

About ARL-RAP

The Army Research Laboratory Research Associateship Program (ARL-RAP) is designed to significantly increase the involvement of creative and highly trained scientists and engineers from academia and industry in scientific and technical areas of interest and relevance to the Army. Scientists and Engineers at the CCDC Army Research Laboratory (ARL) help shape and execute the Army's program for meeting the challenge of developing technologies that will support Army forces in meeting future operational needs by pursuing scientific research and technological developments in diverse fields such as: applied mathematics, atmospheric characterization, simulation and human modeling, digital/optical signal processing, nanotechnology, material science and technology, multifunctional technology, combustion processes, propulsion and flight physics, communication and networking, and computational and information sciences.

A complete application includes:

- **Curriculum Vitae or Resume**
- **Three References Forms**
  - An email with a link to the reference form will be available in Zintellect to the applicant upon completion of the on-line application. Please send this email to persons you have selected to complete a reference.
  - References should be from persons familiar with your educational and professional qualifications (include your thesis or dissertation advisor, if applicable)
- **Transcripts**

- Transcript verifying receipt of degree must be submitted with the application. Student/unofficial copy is acceptable

If selected by an advisor the participant will also be required to write a **research proposal** to submit to the ARL-RAP review panel for :

- Research topic should relate to a specific opportunity at ARL
- The objective of the research topic should be clear and have a defined outcome
- Explain the direction you plan to pursue
- Include expected period for completing the study
- Include a brief background such as preparation and motivation for the research
- References of published efforts may be used to improve the proposal

A link to upload the proposal will be provided to the applicant once the advisor has made their selection.

Questions about this opportunity? Please email ARLFellowship@orau.org

Point of Contact ARL-RAP

Eligibility Requirements

- **Degree:** Bachelor's Degree, Master's Degree, or Doctoral Degree.
- **Academic Level(s):** Any academic level.
- **Discipline(s):**
  - **Chemistry and Materials Sciences** (2 👁)
  - **Engineering** (5 👁)
  - **Mathematics and Statistics** (10 👁)
  - **Physics** (16 👁)
- **Age:** Must be 18 years of age